Installation

Table of Contents

Qualified Persons

⚠ WARNING

Only qualified persons knowledgeable in the installation, operation, and maintenance of overhead and underground electric distribution and transmission equipment, along with all associated hazards, may install, operate, and maintain the equipment covered by this publication. A qualified person is someone trained and competent in:

- The skills and techniques necessary to distinguish exposed live parts from nonlive parts of electrical equipment
- The skills and techniques necessary to determine the proper approach distances corresponding to the voltages to which the qualified person will be exposed
- The proper use of special precautionary techniques, personal protective equipment, insulated and shielding materials, and insulated tools for working on or near exposed energized parts of electrical equipment

These instructions are intended only for such qualified persons. They are not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

Read This Instruction Sheet

NOTICE

Thoroughly and carefully read this instruction sheet and all materials included in the product's instruction handbook before installing or operating the Mark V Circuit-Switcher. Become familiar with the Safety Information on page 3 and Safety Precautions on page 4. The latest version of this publication is available online in PDF format at **sandc.com/en/contact-us/product-literature/**.

Retain This Instruction Sheet

This instruction sheet is a permanent part of the S&C Mark V Circuit-Switcher. Designate a location where users can easily retrieve and refer to this publication.

Proper Application

⚠ WARNING

The equipment in this publication is only intended for the installation of grounding switches on Mark V Circuit-Switchers rated 230 kV through 345 kV. The application must be within the ratings for the equipment. Ratings for the S&C Mark V Circuit-Switcher are listed in the ratings table in Specification Bulletin 711-31. The ratings are also on the nameplate affixed to the product.

Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet and on labels and tags attached to the product. Become familiar with these types of messages and the importance of these signal words:

⚠ DANGER

"DANGER" identifies the most serious and immediate hazards that will likely result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ WARNING

"WARNING" identifies hazards or unsafe practices that can result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ CAUTION

"CAUTION" identifies hazards or unsafe practices that can result in minor personal injury if instructions, including recommended precautions, are not followed.

NOTICE

"NOTICE" identifies important procedures or requirements that can result in product or property damage if instructions are not followed.

Following Safety Instructions

If any portion of this instruction sheet is unclear and assistance is needed, contact the nearest S&C Sales Office or S&C Authorized Distributor, or call the S&C Global Support and Monitoring Center at 1-888-762-1100. Telephone numbers are also listed on S&C's website, sandc.com.

NOTICE

Read this instruction sheet thoroughly and carefully before installing the grounding switch.

Replacement Instructions and Labels

If additional copies of this instruction sheet are required, contact the nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

It is important any missing, damaged, or faded labels on the equipment be replaced immediately. Replacement labels are available by contacting the nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

⚠ DANGER

Mark V Circuit-Switchers operate at high voltage. Failure to observe the precautions below will result in serious personal injury or death.

Some of these precautions may differ from your company's operating procedures and rules. Where a discrepancy exists, follow your company's operating procedures and rules.

1. **QUALIFIED PERSONS**. Access to Mark V Circuit-Switchers must be restricted only to qualified persons. See the "Qualified Persons" section on page 2.
2. **SAFETY PROCEDURES.** Always follow safe operating procedures and rules.
3. **PERSONAL PROTECTIVE EQUIPMENT**. Always use suitable protective equipment, such as rubber gloves, rubber mats, hard hats, safety glasses, and flash clothing, in accordance with safe operating procedures and rules.
4. **SAFETY LABELS.** Do not remove or obscure any of the "DANGER," "WARNING," "CAUTION," or "NOTICE" labels.
5. **OPERATING MECHANISM AND BASE**. Mark V Circuit-Switchers contain fast-moving parts that can severely injure fingers. Do not remove or disassemble operating mechanisms or remove access panels unless directed by S&C Electric Company.
6. **ENERGIZED COMPONENTS.** Always consider all parts live until de-energized, tested, and grounded. Voltage levels can be as high as the peak line-to-ground voltage last applied to the unit. Units that have been energized or installed near energized lines should be considered live until tested and grounded.
7. **GROUNDING.** The Mark V Circuit-Switcher must be connected to a suitable earth ground at the base of the utility pole, or to a suitable building ground for testing, before energizing the switch and at all times when energized.

   The ground wire(s) must be bonded to the system neutral, if present. If the system neutral is not present, proper precautions must be taken to ensure the local earth ground, or building ground, cannot be severed or removed.
8. **SWITCH POSITION.** Always confirm the **Open/Closed** position of each switch.
   - Switches and terminal pads may be energized from either side.
   - Switches and terminal pads may be energized with the switches in any position.
9. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized components.
10. **GROUNDING SWITCH**. Only operate the grounding switch when the Mark V Circuit-Switcher is in the **Open** position. The grounding switch is operated via an S&C Manual Geared Operating Handle installed near the base of the grounding switch. "Partway" opening or closing is undesirable. Once the associated circuit-switcher is in the **Open** position, operate the grounding switch until the grounding switch blades are 90 degrees parallel to the pole-unit bases.

Inspection

Examine the shipment for external evidence of damage as soon after receipt as possible, preferably before removal from the carrier's conveyance. Check the bill of lading to make sure all shipping skids, crates, and containers listed thereon are present.

If there is visible loss and/or damage:

1. Notify the delivering carrier immediately.
2. Ask for a carrier inspection.
3. Note condition of shipment on all copies of the delivery receipt.
4. File a claim with the carrier.

If concealed damage is discovered:

1. Notify the delivering carrier within 15 days of receipt of shipment.
2. Ask for a carrier inspection.
3. File a claim with the carrier.

Also notify S&C Electric Company in all instances of loss and/or damage.

Packing

An S&C erection drawing will be found in a water-resistant envelope attached to one of the three pole-units. The inclusion of a grounding switch is designated by the addition of a suffix to the circuit-switcher catalog number as follows:

- The inclusion of a grounding switch rated 70,000 amperes momentary is designated by the addition of the suffix "-G3" to the circuit-switcher catalog number.

Grounding switch components already installed on the circuit-switcher pole-units have been carefully adjusted at the factory and, under normal circumstances, readjustment should not be necessary.

Grounding switch components and subassemblies are packaged separately for shipment. They are tagged and keyed to the bill of material on the erection drawing to facilitate field erection.

Study the erection drawing carefully determine the overall configuration and the arrangement of components. Then proceed as directed in the step-by-step instructions.

Storage

If the grounding switch components must be stored before installation, keep them in a clean, dry, corrosion-free area to protect them from damage. Make sure each skid rests firmly on the ground and is reasonably level. Shoring under the skids may be necessary if the ground is uneven.

Before Starting

NOTICE

Installing Couplings with Piercing Set Screws

This equipment uses piercing set screws to couple the operating handle to the operating pipe, to secure the interphase operating-pipe sections, and to provide stability to couplings joining one or more lengths of pipe.

Before assembling a coupling joint, back the piercing set screws out of the coupling so the tips do not protrude into the body of the coupling. This ensures the coupling's clamp screws can be fully tightened.

These instructions are for field assembly and installation of manually operated S&C Grounding Switches, rated 70,000 amperes momentary, when furnished as original equipment for Mark V Circuit Switchers rated 230 kV and 345 kV. Supplemental dimensional details for the grounding-switch installation are included on the erection drawing for the applicable circuit-switcher.

Install the grounding switch only after the circuit-switcher and its power train have been completely installed and adjusted.

Note: If a grounding switch is to be added to an existing circuit-switcher installation, the components should be assembled in accordance with the special drawings provided.

Note: An S&C Manual Geared Operating Handle is used to operate the grounding switch. The nongeared handle is not available.

Installing the Grounding Switch

Proceed with the following steps:

STEP 1. For each circuit-switcher pole-unit, assemble the grounding-switch live parts as follows:

(a) Mount the jaw-contact assembly on the side of the circuit-switcher terminal support casting (at the interrupter end) using the ⅝–11 × 1½-inch stainless steel hex-head cap screws and lockwashers. See Detail A-A in Figure 2 on page 9. The screws used to attach the jaw contact should be left loose enough for adjustment.

(b) Attach the grounding-switch support brackets to the circuit-switcher base as shown on the erection drawing and Figure 1 on page 7 and Figure 2 on page 9.

(c) Attach four ⅝–11 × 4½-inch threaded rods to the support brackets; each uses two hex nuts. Tighten the nuts securely. Then, attach a third hex nut used to level the grounding-switch assembly to each of the four threaded rods, positioned so the top surface of each nut is approximately 1⅝ inches (41-mm) above the top surface of the mounting angles.

(d) Install the grounding-switch assembly atop the threaded rods and leveling nuts using the lockwashers and hex nuts. Loosely tighten these uppermost hex nuts.

(e) Slowly close the grounding-switch blade into the jaw-contact assembly until the blade contact just enters the jaw-contact fingers. The blade contacts should enter the jaw-contact fingers on-center; if adjustment is required, raise or lower the appropriate leveling nuts supporting the grounding switch assembly.

To avoid changing the effective height of the assembly, do not adjust more than three of the four leveling nuts. When on-center blade travel has been attained, securely tighten the bolts fastening the jaw contact.

(f) Adjust the leveling nuts further so the grounding-switch blade applies a definite pressure to the jaw-contact fingers on closing (to ensure positive contact engagement) and rests against its stop when fully closed. Check for proper blade closure by pulling the blade away from its **Closed** position. See Figure 3 on page 10. With the blade fully closed and resting against the nylon stop in the jaw assembly, it should be possible to move the blade no more than ½ inch (13-mm) before meeting positive resistance. When proper blade closure has been attained, securely tighten the uppermost set of hex nuts used to attach the grounding-switch assembly to the support brackets.

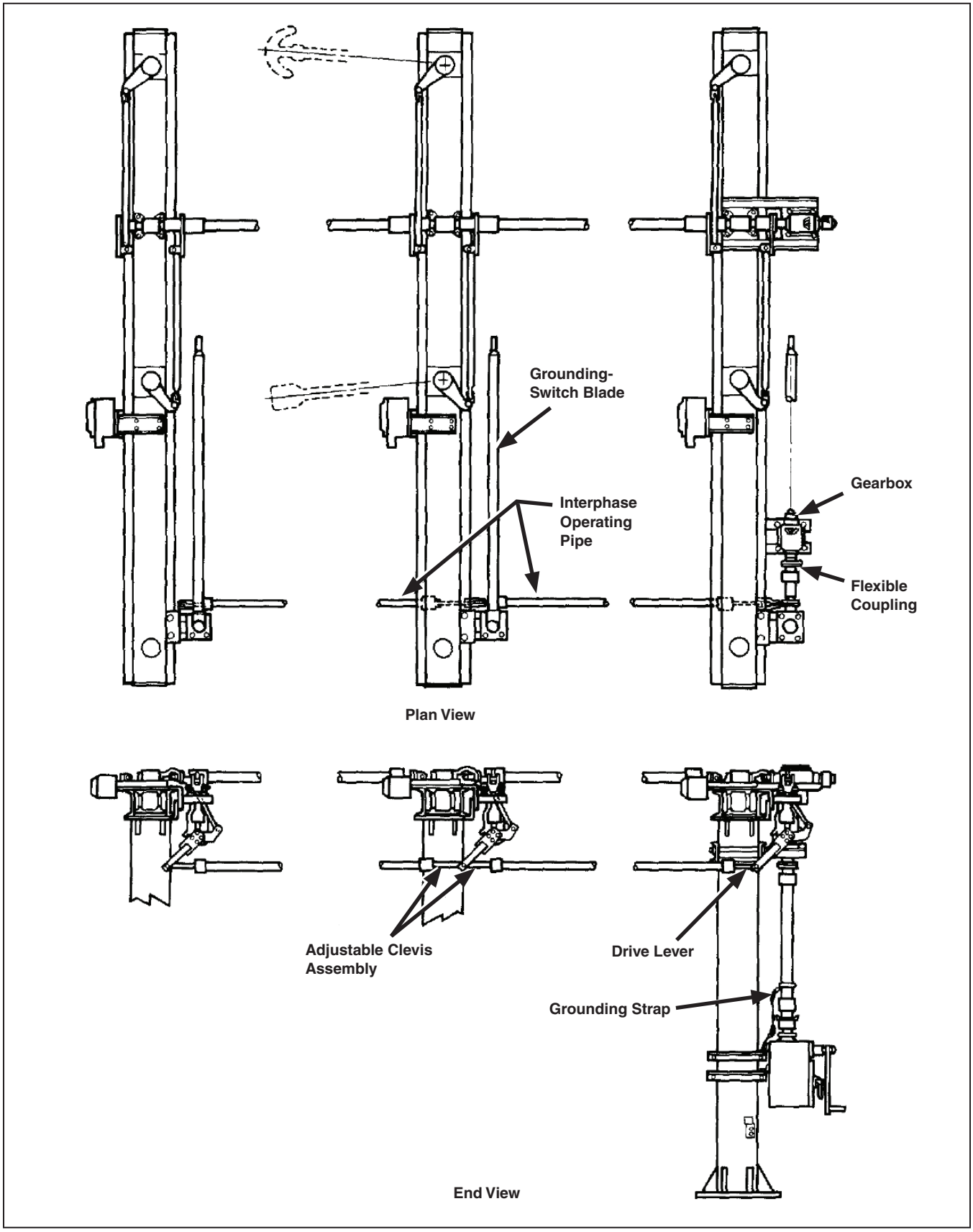

Figure 1. Grounding-switch live parts attachment detail.

(g) Attach the flexible strap for current transfer at the hinge end of the blade assembly to the grounding switch mounting angle using the ½-inch stainless steel hardware. Then, connect the mounting angle to a suitable earth ground.●

STEP 2. Mount the gearbox in the position shown on the erection drawing.

Attach a flexible coupling to the input shaft of the gearbox. See Figure 1 on page 7. Thread the attachment bolts through the flexible coupling plate and through the coupling flange on the input shaft. Tighten the bolts to draw the flexible plate flush against the flange; this will deform the threads in the flexible plate, resulting in a binding, nonslip connection. Install and tighten the self-locking nuts. Do not use lockwashers with the attachment bolts.

STEP 3. Mount the S&C Manual Geared Operating Handle in the position shown on the erection drawing.

Attach a flexible coupling to the output shaft of the geared operating handle. See Figure 2 on page 9. Thread the attachment bolts through the flexible coupling plate and through the coupling flange on the output shaft. Tighten the bolts to draw the flexible plate flush against the flange; this will deform the threads in the flexible plate, resulting in a binding, nonslip connection. Install and tighten the self-locking nuts. Do not use lockwashers with the attachment bolts.

STEP 4. Install the vertical operating-pipe section (or sections) and, if required, the guide bearing assembly (or assemblies) between the flexible coupling at the gearbox and the flexible coupling at the handle. Work from the gearbox downward.

If more than one vertical operating-pipe section is specified, a universal coupling is used to join the upper pipe section to the next pipe section. Any additional pipe sections are joined with rigid couplings.

Torque the clamp bolts to final tightness. Then tighten the piercing set screws, piercing the pipe, and continue turning until a firm resistance is felt.

STEP 5. Fully close each grounding-switch blade assembly. Attach an adjustable clevis assembly (or assemblies) to each grounding-switch assembly drive lever, using the stainless steel pin, spacers, flat washer, and cotter pin furnished, as shown on the erection drawing.

STEP 6. Install the interphase operating-pipe sections in the adjustable clevis assemblies. All pipe is furnished precut to the correct length. For each clevis assembly, make certain that the cutting tips of the piercing set screws do not protrude through the body of the coupling. Tighten the U-bolts equally so that they pull down evenly; then tighten the piercing set screws, piercing the pipe, and continue until a firm resistance is felt.

STEP 7. Attach a flexible coupling to the output shaft of the gearbox. Thread the attachment bolts through the flexible coupling plate and through the coupling flange on the output shaft. Tighten the bolts to draw the flexible plate flush against the flange; this will deform the threads in the flexible plate, resulting in a binding, nonslip connection. Install and tighten the self-locking nuts. Do not use lockwashers with the attachment bolts.

Make certain that the cutting tips of the piercing set screws do not protrude through the body of this flexible coupling. Then, install the interphase link between the flexible coupling and the grounding-switch assembly drive lever. Attach the interphase link to the drive lever using the ½ -13 × 3-inch hex-head stainless steel cap screws furnished. Tighten the U-bolts on the flexible coupling equally so that they pull down evenly; then tighten the piercing set screws on the flexible coupling, piercing the pipe, and continue turning until a firm resistance is felt.

● These grounding recommendations may differ from the standard operating and safety procedures of sure electric utility companies. Where a discrepancy exists, the operating procedures of the electric utility apply.

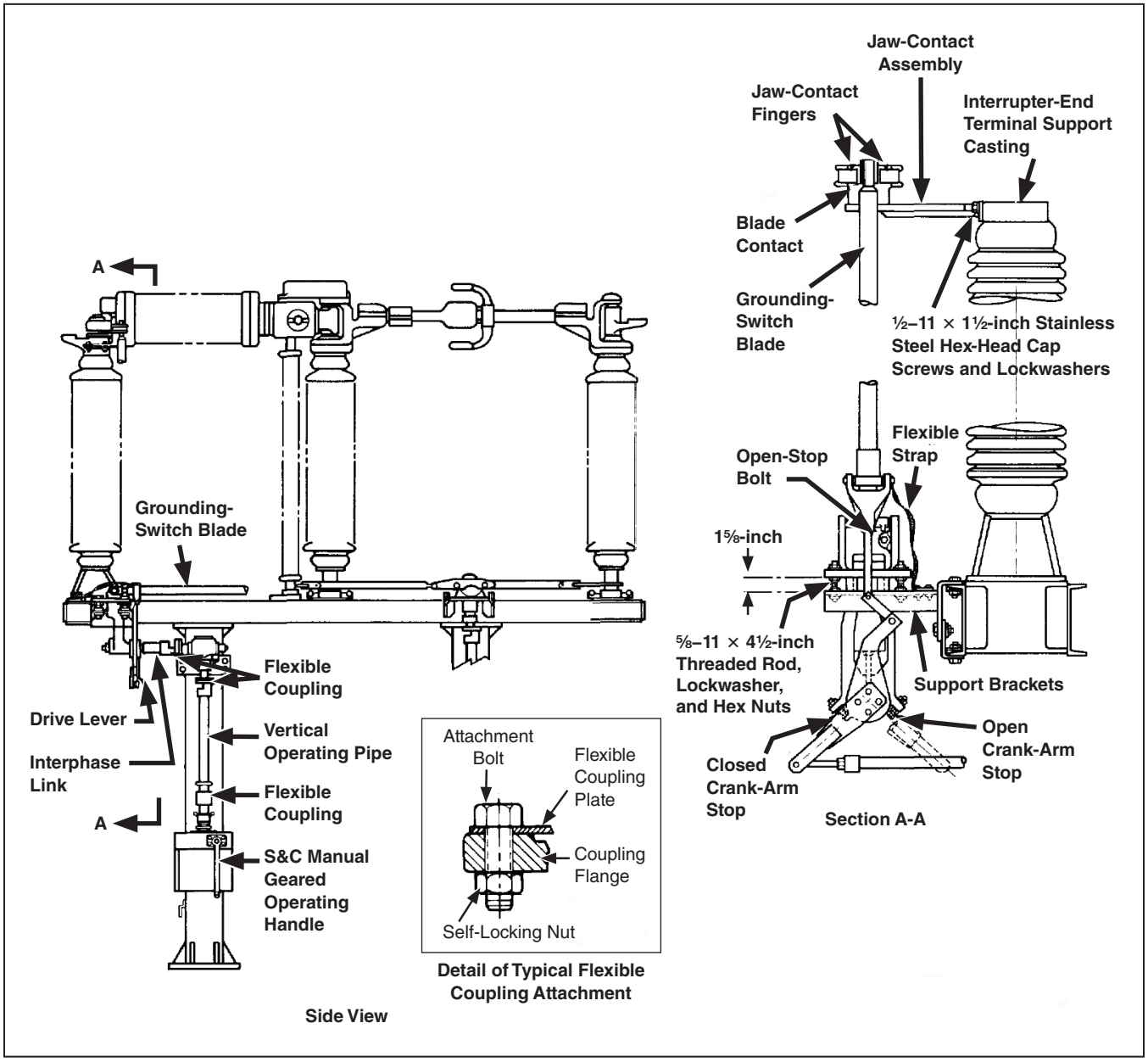

Figure 2. Typical three-pole grounding-switch configuration.

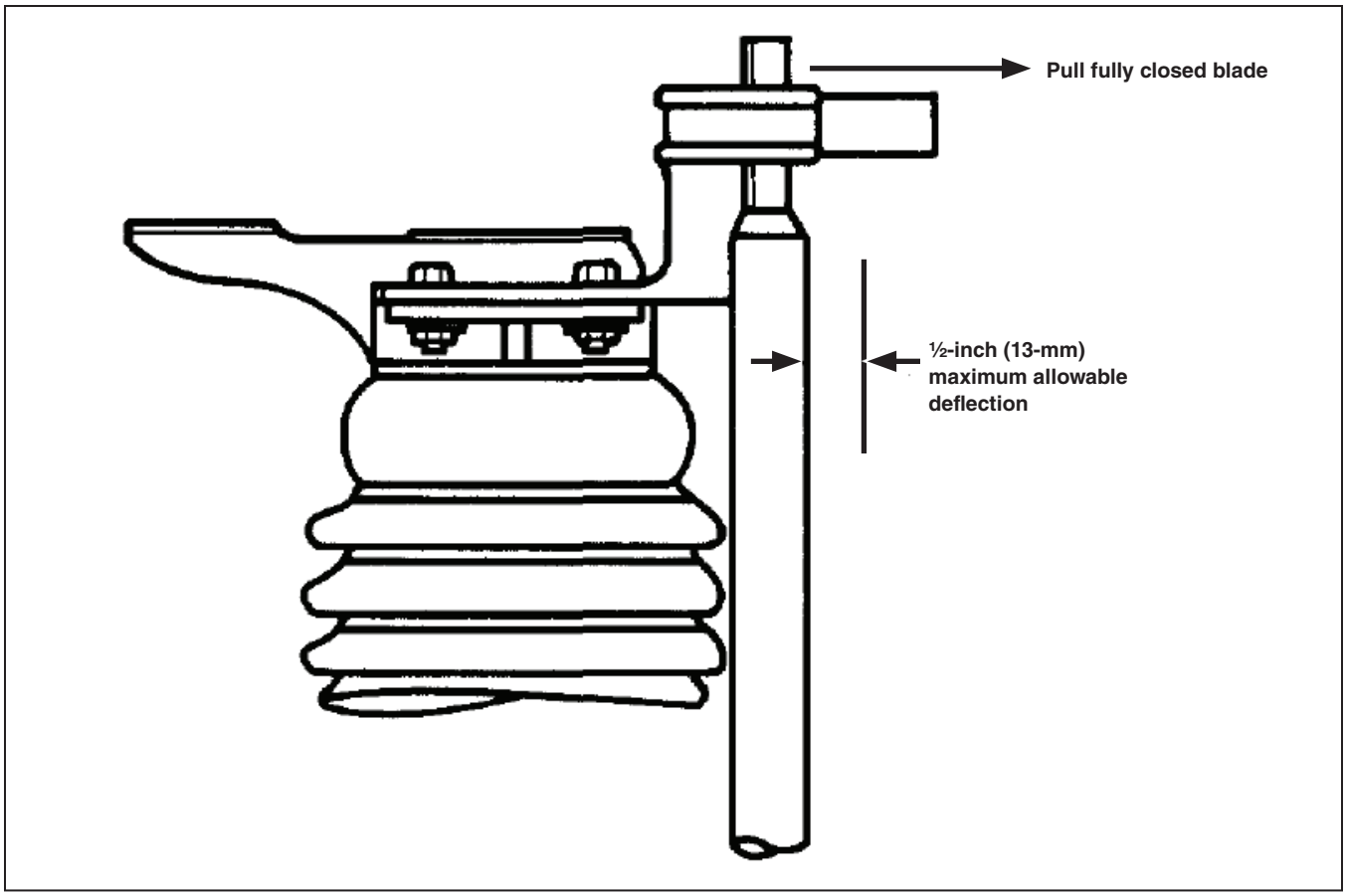

Figure 3. Blade closure verification.

STEP 8. Using the manual geared operating handle, crank the grounding switch to the fully Open position and then to the fully **Closed** position to check three-pole group operation. It may be necessary to change the effective length of the interphase operating pipe by adjusting the clevis assemblies. Note that it is usually necessary, when closing, that the blade assembly farthest from the gearbox slightly lead the blade assemblies nearer to the gearbox, to compensate for lost motion in the interphase linkage.

Do not attempt to change the Open and Closed stops for the grounding-switch assembly drive levers. These stops are factory set to provide, for all three blade assemblies, equal travel as well as the required positive-toggle condition when closed.

STEP 9. Check the cranking-direction label located on the front of the manual geared operating handle. If the "To Open" and "To Close" cranking directions indicated are incorrect, remove the screws holding the cranking direction label. An alternate-reading label is attached behind it and should be used instead. See Figure 4 on page 12.

STEP 10. If a key interlock is not specified, omit Step 10. The key interlock group includes a Superior Key Interlock, Type B-4003-1, with stainless steel locking bolt, zero bolt projection, and ¾-inch bolt travel; a hinged dust cover; an interlock adapter; and an interlock collar bolted to the output shaft of the manual geared operating handle. The interlock collar is provided with a slot to accept the key interlock bolt. If "provision only" for a key interlock is specified, the interlock will not be included. Proceed as follows:

(a) Using the manual geared operating handle, crank the grounding switch to its fully **Open** position.

(b) Remove the bolts fastening the interlock collar to the output shaft.

(c) Rotate the interlock collar so the key interlock bolt, when extended, is centered in the slot in the collar. Then, replace and tighten the bolts to fasten the interlock collar in that position. Similar bolts are also used for the OPEN and CLOSED position indicators, which are to be set as described in Step 11.

STEP 11. Using the manual geared operating handle, crank the grounding switch to its fully **Open** position and set the OPEN position indicator on the output shaft of the manual geared operating handle so it is visible from the front of the handle. Then, fully close the grounding switch and set the CLOSED position indicator on the output shaft of the manual geared operating handle so the indicator is visible from the front of the handle.

STEP 12. Ground the vertical operating pipe as follows. Fasten the end of the flexible strap having the shorter ferrule to the vertical operating-pipe section, a few inches above the manual operating handle, using the connector provided. Then, connect the free end of the flexible strap to a suitable earth ground using the grounding connector at that end of the strap.●

STEP 13. If the S&C Manual Geared Operating Handle is furnished with an auxiliary switch, catalog number suffix "-Q" or "-W," the switch will be mounted inside the operating-handle enclosure, along with a terminal block for the user's connections. Each auxiliary-switch contact is operated by a cam-actuated roller.

A contact is closed if its roller is disengaged from a cam and, conversely, a contact is open if its roller is engaged by a cam. The cams are individually adjustable in 4.5-degree increments. Adjustment of the cams is accomplished as follows:

(a) Raise (or lower) the cam toward its adjacent spring until the cam is separated from the teeth of the inner gear. See Figure 5 on page 13.

(b) Rotate the cam to advance or delay engagement with its roller.

(c) Lower (or raise) the cam, making sure the teeth are in mesh with the inner gear.

● These grounding recommendations may differ from the standard operating and safety procedures of certain electric utility companies. Where a discrepancy exists, the operating procedures of the electric utility apply.

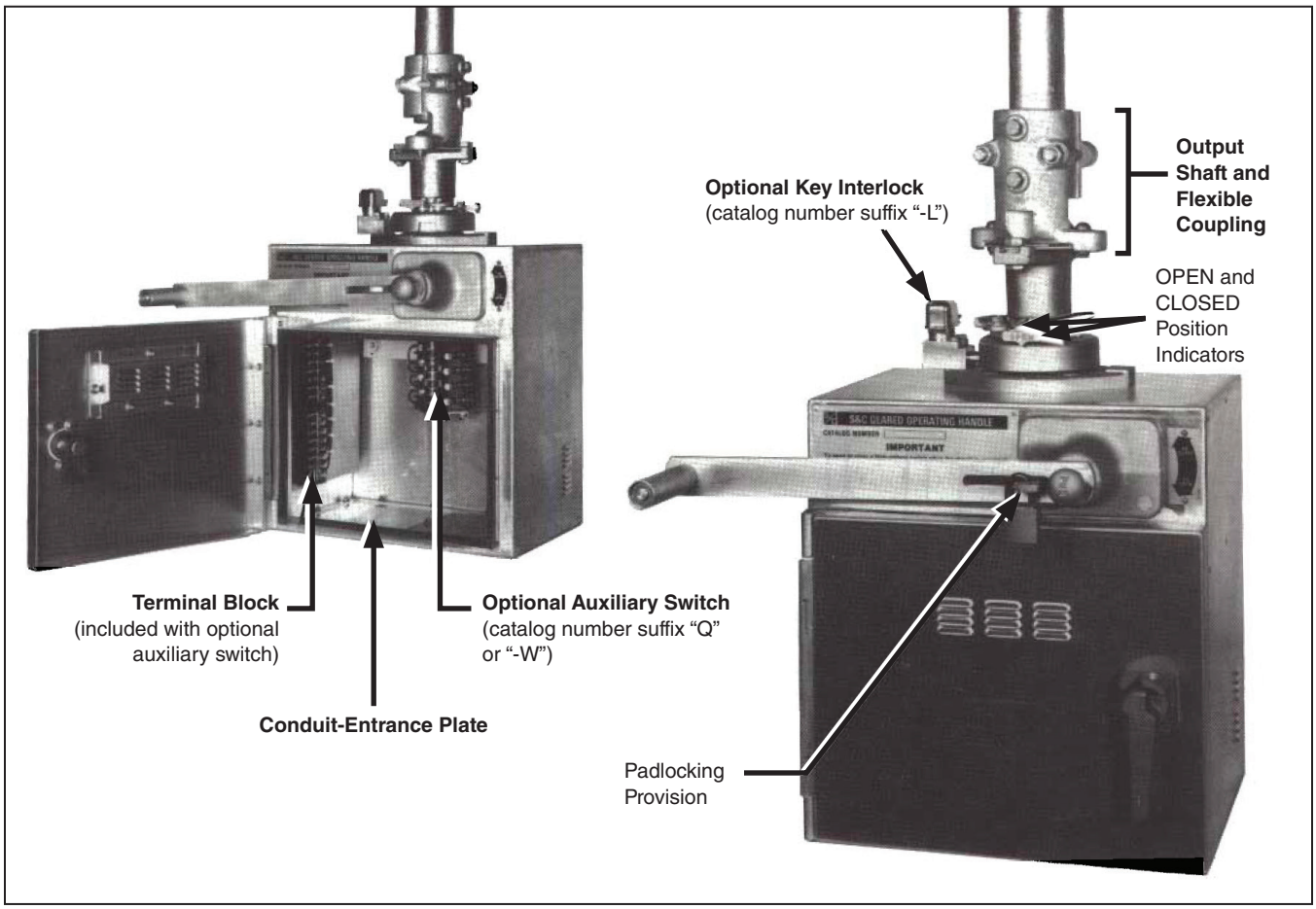

Figure 4. Manual Geared Operating Handle.

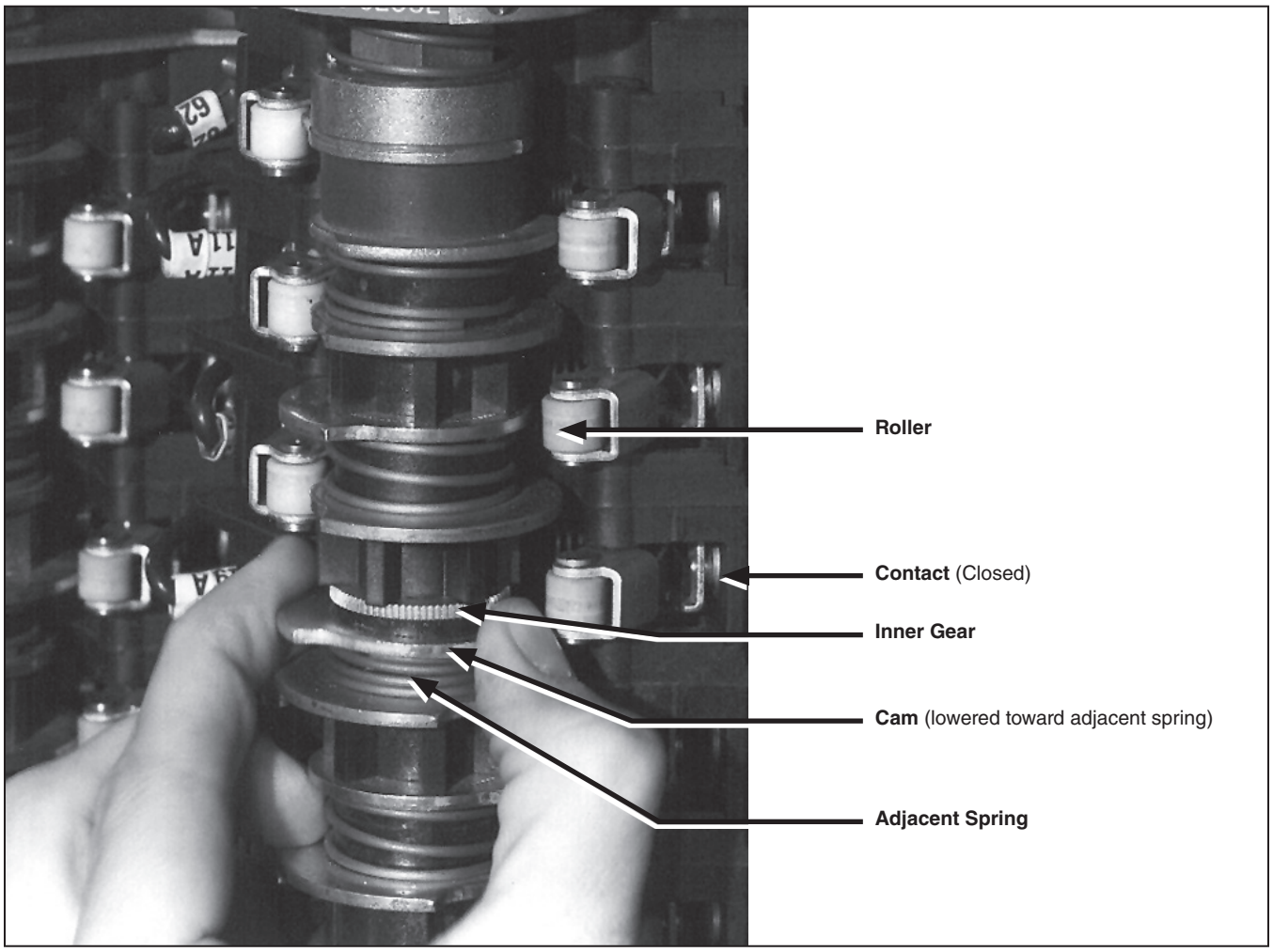

Figure 5. Adjustment of cams on auxiliary switch.

Inspection Recommendations

To ensure the grounding switch's continued proper procedures, it should be inspected in accordance with S&C's recommended schedule and procedures contained in S&C Instruction Sheet 711-590.